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ABSTRACT

Discussion and research concerning class size can be traced back at least to the 12th century. An overview of recent research on the subject is provided in this report. The paper, which serves as an introduction to a symposium on class size, examines research that has appeared in the past 20 years, but it concentrates on the results of a longitudinal study--Project STAR (Student Teacher Achievement Ratio)--that was considered a controlled experiment for class size research. The results of STAR and other similar programs show that students do benefit from smaller class sizes, and these results are reinforced by any study that finds a positive relationship between tutoring and achievement, cooperative learning and positive results, and other programs that emphasize small-group learning. Critics have claimed that the studies are in error or that, even if effective, such programs are much too expensive to implement. But, it is countered, research has not shown the harmful effects of small classes or that larger classes are better for children. It is hoped that the research on class size will influence educators and policy makers to move forward on this issue. (Contains approximately 125 references.) (RJM)

IF NOT BEFORE, AT LEAST NOW

PAPER PRESENTED AT A CLASS-SIZE SYMPOSIUM (4/14/98)

AMERICAN EDUCATIONAL RESEARCH ASSOCIATION (AERA)

1998 ANNUAL MEETING, 4/13-4/17, 1998

SAN DIEGO, CA

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If Not Before, At Least Now * AERA, 1998

A Quick Tip-Toe Through Class-Size Antecedents

Although I am not a historian by training, nevertheless, like many of the rest of us, I have lived enough years that the younger generation considers me history. My task is to trace briefly the class-size concerns and research as an introduction to the serious ideas and papers prepared for this meeting.

Although according to Angrist and Lavy (1996) the study and use of class size regarding student achievement began in the 12th century when Maimonides, the great Rabbinic scholar laid out the principles of class size according to concepts presented in the Talmud, for my purposes the present emphasis on class size dates from the Glass & Smith (1978) meta-analysis of a selection of some earlier studies. The Glass & Smith paper was followed quite quickly by two publications from the Education Research Service (ERS, 1978, 1980), by the publication of an "Experimental study of the effects of class size," (Shapson, Wright, Eason & Fitzgerald, 1980), by the Glass, Cahen, Smith, & Filby, book (1982), and a book by Cahen, Filby, McCutcheon & Kyle (1983). Except for Shapson et al., this foment for future progress, like many other changes in education direction, was essentially built by looking backward. The interest was driven by analyses of studies years ago, by common sense, and by a growing uneasiness that present-day, generally poorly researched education practices will not address current problems.

While this regeneration of class-size interest was occurring with the publication a few studies, journal articles, and books, the State of Indiana was quietly launching Project Prime Time (Chase, Mueller & Walden, 1986). Although Prime Time had provisions for evaluation, it was primarily a project, and not research. It began with the reduction of class sizes in grades 1 and 2 in selected districts. A local-district option to reduce class sizes in either kindergarten (K) or grade 3 was available for the third year. Results generally favored small classes, but findings were mixed. (Chase, Mueller, & Walden, 1986; Mueller, Chase, & Walden 1988).

At about the same time as the first results were available from Prime Time, a small study was begun in two schools in metro-Nashville, TN. This study was initiated by Helen Bain who had not long before that served as president of the National Education Association (NEA) where one of her main interests was to get class sizes to a reasonable level so teachers could teach and children could learn. Results of the DuPont Study became available in

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journal form (Whittington, Bain, & Achilles, 1985; Bain, Achilles, Dennis, Parks, & Hooper, 1988), and although small in size, the results were very large in impact.

DuPont results added to Prime Time and to earlier studies, and launched a major education experiment. The Tennessee legislature passed House Bill 544 which established a state-wide experiment to determine the effects of small classes (about 1 teacher and 15 students, or 1:15) on the achievement and development of early primary (grades K-3) youngsters. As a hedge against possible large costs of small classes, the legislature also wanted to know the benefits of a full-time instructional aide in a class of about 22-26 pupils.

Project STAR and Its Development

Project STAR (Student Teacher Achievement Ratio) was a longitudinal state-wide randomized experiment. By 1998, more than 11,000 students had been tracked on the database if they had been assigned at random to one of the three conditions in the study. Those three conditions were a Small class (S) of approximately 1:15 (a range of 13-17), a Regular class (R) averaging 1:25 with a range of 22-26, and a Regular class with a full-time Aide (RA). STAR included 79 schools in 46 of Tennessee's (then) 140 school districts. Researchers employed an in-school design to control for building and district variables: Any school that had an (S) class also had both other conditions (R, RA). Researchers also identified a set of comparison schools (n=21) matched closely with the STAR schools. From these schools they collected achievement-test data each year when STAR students were tested. Because of the parsimony and rigor of the in-school design, little use has yet been made of the comparison schools, except for an analysis of differences in random and non-random assignments of pupils in (R) classes (Zaharias, 1993; Zaharias, Achilles, Nye, & Cain, 1995; Zaharias, Achilles, & Cain, 1995).

The STAR researchers followed youngsters who entered kindergarten in 1985 (n=6325) until they left grade 3 in 1989. Students were assigned at random to class sizes and teachers were assigned at random to classes. Students (about 1,200) who did not enter school in K, but did enter in grade 1 were assigned at random when they entered STAR in 1986. Students stayed together each year (cohort), except for student mobility. Teachers were re-assigned as the cohorts moved through the grades. Except for random assignments and the establishment of S, R, and RA classes, researchers changed nothing else in the schools. The four principal investigators (PIs) represented four Tennessee universities (Vanderbilt, Tennessee State University or TSU, The University of Tennessee or UT, and The University of Memphis). There were advisory boards, etc. A research design consultant who was external to the study office (Finn) was hired to conduct the primary STAR analyses. The PIs also analyzed data.

STAR's Progeny

STAR cost over 12 million dollars in its first four years and generated many other studies, some of which are continuing today. Researchers in the Lasting Benefits Study (LBS) have been tracking STAR youngsters to see just how long and to what degree the small-class benefits would remain.

Project Challenge was a policy application of STAR findings. Sixteen of Tennessee's poorest and educationally low-scoring school districts were "challenged" to use the STAR findings to improve their student outcomes. If they reduced class sizes, the governor provided funds to help those districts. Although Challenge was not an experiment, researchers followed the results by tracking the average rankings of the Challenge districts among the state rankings of districts on student outcomes in reading and math. Districts that did use STAR results to reduce class sizes to about 1:15 in grades K-3 moved up in the state's ranking of school districts on grade 2 and grade-3 tests. (Nye et al., 1993; Achilles et al., 1995; Mosteller, Light, & Sachs, 1996)).

Researchers have used STAR's large database to explore education-related questions in many ancillary studies. For example, researchers examined such issues as random vs. non-random assignment of students using STAR and the comparison schools, school size and class size, class-size effects to reduce the achievement gap between minority and non-minority students, student behavior and discipline, student participation and engagement in schooling, and the impact of class size on student identification with schools. Table 1 lists some STAR-related studies, both those using the STAR database and other studies that began as a result of STAR findings.

TABLE 1 ABOUT HERE

Class size matters.

The STAR, LBS, and Challenge results were made available each year. Finn & Achilles, (1990) discussed the results from STAR's first two years. Many articles, research reports, conference papers, monographs, and ERIC entries have followed, in which the authors have discussed STAR results and/or the results of ancillary studies with language targeted for a number of different audiences. (A representative bibliography is included after the References).

Eventually, the STAR findings attracted some attention. Notable here were the critical comments of two respected researchers. Orlich (1991) said:

> The study lasted for four years and, in my opinion, is the most significant educational research done in the US during the past 25 years (p. 632).

STAR was a tightly controlled, longitudinal, experiment of class size. Professor Emeritus Mosteller (1995) said about STAR:

> This article briefly summarizes the Tennessee class size project, a controlled experiment which is one of the most important investigations ever carried out and illustrates the kind and magnitude of research needed in the field of education to strengthen schools (p. 113).
>
> Because a controlled education experiment (as distinct from a sample survey) of this quality, magnitude, and duration is a rarity, it is important that both educators and policy makers have access to its statistical information and understand its implications. (p. 126).

Professor Orlich proposed using research results as a base for school improvement. Professor Mosteller (1995) and Mosteller, Light, and Sachs (1996) argued forcefully that STAR and studies similar to STAR in terms of design and rigor should be used to inform educational policy decisions.

Tennessee policy persons made efforts to reduce class sizes K-3 throughout the state, and by 1994 other states began to follow suit. As class-size information became more available, there have been visible uses of it, such as in California where there was a voluntary state-wide effort to reduce the class size in grades K-3. California's initiative has been followed closely, and coverage of it has appeared in general publications, such as Education Week, (E.g., Johnson, 1997), U. S. News and World Report, Time, etc.

As of January, 1998 approximately 27 states either had class-size legislation, had debated the topic seriously, or had initiatives to test out the impact of class-size reduction for various conditions. Educators and policy persons in several foreign countries are considering or are using class-size efforts: The Netherlands, England, Australia, Canada. There is some federal interest in class-size adjustments, especially in America's poorest schools. (See President Clinton's 1998 State of the union message).

Thus, from fairly small beginnings in about 1978-1980, it's taken approximately 20 years for class size to be considered seriously, and about 10 years for results of one education experiment (STAR) to get into general and relatively wide-spread use in American education. This is evidence of lethargy among educators and neglect of adults for the well being of youths.

Some Contentiousness in Using Class-Size Results

Uses of STAR findings have generated predictable controversy in the literature and among researchers, politicians, and policy folks. Some people have said that there may be more efficient ways to improve student achievement. There are claims about the lack of efficiency of reducing class

size in the early grades. This amazing assault on serious longitudinal, replicable research is based on little but speculation -- Shakespeare might have said "sound and fury." For example, how can one really understand the "efficiency" of reducing class sizes until there are enough small-class activities around for serious study of them?

What research has shown harmful effects of small classes, or that larger classes are better for children? What successful education project or intervention does not rely on a small-class effect? Research on tutoring and on cooperative learning should be considered class-size research. Many alternatives to regular public education build upon a small-class effect: Home schooling, alternative schools, charter schools, expensive private schools, apprenticeships.

Rather, the anti-class-size literature has been full of hypothetical discussions of how something else (we're not quite sure what that is) might be a better way to get at the same achievement and behavior questions that we're getting with the stream of class-size work. How much of the success of some popular projects and remedies should be attributed to small classes: Reading Recovery (RR), Success for All (SFA), and others?

This Symposium as a Start on Heuristics and Systemics

Thus, we come to a symposium today where we'll consider some class size research and activities. We'll also review not just what's been going on, and some of the achievement and development findings, but we'll begin to consider some of the emerging economic analyses of class size which should NOT be confused with Pupil-Teacher Ratio, or PTR. (Achilles, 1997; Achilles, Sharp, & Nye, 1998; Lewis & Baker, 1997; US Department of Education, 1996 and 1997). Class size is the number of children in a class for whom the teacher is responsible; PTR is the number of children at a site divided by the number of professional educators there. Class size influences student outcome positively (e.g., Finn & Achilles, 1990; Robinson, 1990; Wenglinsky, 1997) and PTR doesn't (e.g., Boozer & Rouse, 1995).

We'll surely have more of these discussions, as in the later years of STAR (STAR pupils are now mostly in grade 12) we're now beginning to understand the long-term effects of early (S) education on later student behavior (e.g., Bain, et al., 1997); issues of student drop-out or retention in grade; the "trade-offs" in various implementations as policy analysis research; and some heuristics involving space use, etc.

In the research emphasis on class size, the teacher aide (RA) question has not been fully examined, but it can be since STAR's design could as easily make STAR an experimental study of RA effects. It is noteworthy here that of the three STAR conditions, (S) was best, generally followed by (R) and then (RA). This finding may help explain some of the mixed results in Prime Time.

(Chase, Mueller, & Walden, 1986) and the continuing run of poor evaluations of one aide-loaded federal education policy, Title I.

As added answers to our questions become available, we shall have much more definitive information about whether or not reducing class size is "efficient." We believe that the STAR-generated stream of class-size research has answered the question about the effectiveness of early small-class interventions. We're not sure what the relationship should be between efficiency and effectiveness when we're talking about people, and particularly about the very youngest people who are beginning their long trek through our education system. Benjamin Bloom (1984 a&b) asked that educators seek answers to his "2-sigma problem" and "search for methods of group instruction as effective as one-to-one tutoring." Appropriate-sized classes in K-3 are a start: they offer Quality (higher achievement), Equality (all participants get the same), and Equity (minority and hard-to-teach youngsters benefit more). (Achilles, Finn, & Bain, 1997-98; Finn & Achilles, 1990; Robinson, 1990; Wenglinsky, 1997, etc.).

Critical discussion and debates about class-size processes have been initiated by economists, policy folks, and statistical types, such as Burtless, (1996), Card & Krueger (1996), Hanushek (1995, 1996), Hedges and others (1994, 1996). A recent wave of added interest in the economics of class-size processes and outcomes is evident in the work of Angrist and Lavy (1996), Boozer and Rouse (1995), Correa (1993), Krueger (1997), and Wenglinsky (1997). Soon we might expect to see class-size connected to space usage (proxemics) and the possibility that crowding little children may contribute to later difficult behavior, such as the onset and nurturing of gangs in schools, or that large classes add to stale air that adds to teacher fatigue and student inattentiveness late in the school day. What are the implications of (S) for use of time and technology? For improved school-home relationships? For innovative use of space and personnel? How does early schooling in small classes extend recent findings of brain research, cognitive psychology, neuroscience?

If we've not had really serious discussions on class size issues and implications before, at least let's get serious about a research-driven base for major policy shifts in American education. We know what to do to improve early schooling for children. How to do what research shows should be done is a fair question for enlightened policy discussions, political decisions, educational leadership and a new series of education studies. Time is wasting. Let's start. NOW!

Table 1. Samples of Studies Derived from and Building upon STAR, Classed as "Subsidiary" (directly from STAR), "Ancillary" (building on STAR database) and "Related" (usually involving STAR researchers).

CATEGORY, TITLE & PURPOSE *	DATE(S)	AUTHOR(S) OR PUBLICATION DATE
STAR (Many sources)	1985-1989	Word, et al., 1991 Finn & Achilles, 1990
Subsidiary Studies		
• Lasting Benefits Study	1989-Present	Nye et al., 1991-1996
• Project Challenge (TN)	1989-Present	Nye et al., 1991-1996
• Participation in Grades 4, 8	1990, 1996	Finn, 1989, 1993; Voelkl, 1995 Finn, et al., 1989, 1990 Finn and Cox, 1992
• Follow-up of STAR students	1996-1998	HEROS (1997)
Ancillary Studies (Use or extend STAR. Some dissertations.)		
• Retention in Grade	1994	Harvey, 1994
• Achievement Gap	1993-1995	Bingham, 1993
• Value of K in Classes of Varying Sizes (test scores)	1985-1989	Achilles, Nye, Bain
• School Size and Class-Size Issues	1985-1989	Nye, K., 1995
• Random v. Non-Random Pupil Assignment and Achievement	1985-1989	Zaharias, et al., 1995
• Class Size and Discipline in Grades 3,5,7	1989, 1991, 1996, etc.	Several studies. Hibbs (1996).
• Outstanding Teacher Analysis (top 10% of STAR teachers)	1985-1989	Bain et al., 1992
Related Studies		
• Success Starts Small: Grade 1 in Chapter 1 (1:14, 1:23) Schools	1993-1995	Achilles et al., 1995
• Burke Co., NC Study	1992-1998	Achilles et al., 1994
• Education Production Functions	1996-1997	Krueger, A. B. (1997)

* This list is not complete. It provides samples of the types of studies done. Not all authors appear in the references in the exact way listed here. This table appears in several STAR reports in substantially this same form. For a list of all references, see Achilles (1996b).

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